An Easy, Inexpensive Test Detects Tuberculosis in Livestock and Wildlife

The United States has come close to eliminating bovine tuberculosis (TB). Before USDA launched a tuberculosis eradication program in 1917, 5 percent of the nation's cattle were infected. That figure dropped to 0.015 percent by 1990.

But recent developments demonstrate that *Mycobacterium bovis*, the causative agent of bovine TB, is far from eliminated. In Michigan, an outbreak among white-tailed deer that may have started in livestock has spread to at least 20 cattle herds. Importation of Mexican feeder cattle has sparked concerns in Texas, where two herds have tested positive. In both states, the disease has led to economic woes and forced depopulation of infected herds.

That is why an invention by scientists at ARS' National Animal Disease Center in Ames, Iowa, may be not only revolutionary, but also very timely.

PEGGY GREB (K10096-1)

Veterinarian Ray Waters collects a blood sample from an elk for the nitric oxide assay, a new test for detecting tuberculosis in animals.

The breakthrough—a new blood-based test for detecting TB in animals—is important because it is applicable for most if not all species of mammals, and requires only a single blood sample. That means animals are handled just once rather than twice.

Veterinarians Ray Waters and Mitch Palmer, who work in the center's Bacterial Diseases of Livestock Research Unit, have submitted a patent application for the assay. Developed over 2 years, the invention is an inexpensive and easy process to be used mainly by diagnostic laboratories and regulatory agencies, says Waters.

Currently, the only government-approved TB-detection method is the cumbersome skin test.

"With it," says Waters, "a crude mixture of tuberculosis antigens is injected into the skin of the animal, and any ensuing reaction must be measured 72 hours later. When the animal is handled again, it can lead to injury and stress, especially to wildlife species."

The TB bacterium can be inhaled or ingested and is spread mainly through the respiratory and lymphatic systems. It exists in three main types: human, avian, and bovine. Bovine TB can infect most mammals, including wildlife.

Palmer says the new, still-unnamed test can detect all three types as long as proper antigens are used. The assay may even be used to discriminate between bovine and avian TB, although further studies are needed.

He says that another test, an interferon gamma assay already in use for livestock, is based on the same blood-culture principle as their procedure. But it cannot be applied to other species and can be used only in conjunction with the skin test.

According to Waters, the invention will likely be used to detect TB in livestock species such as cattle, sheep, and goats, as well as in wildlife species such as deer, bison, and elk. It can also work for humans, he says, although it is not an adequate replacement for the current tests.

Nitric Oxide Is the Key

The test detects nitrite, as an indication of nitric oxide production, in blood-sample cultures. Mammals produce nitric oxide as a natural response when fighting TB. While the interferon gamma assay uses species-specific monoclonal antibodies, the new test uses a detection method that will likely work for many mammals. This is possible because nitrite is a chemical easily detected within samples from all species.

The interferon gamma assay currently in use measures a chemical messenger produced by white blood cells fighting TB and other infections. Interferon gamma, unlike nitrite, differs between species, so new reagents are needed for each species tested.

PEGGY GREB (K10098-1)

Technician Theresa Rahner begins to process an elk blood sample for the nitric oxide assay.

PEGGY GREB (K10094-1)

A couple of white-tailed deer from the National Animal Disease Center research herd feed from the hand of Ray Waters.

Concern over the spread of bovine TB goes beyond cattle and profits. "It is a public health concern," says Palmer. "As an example, before the eradication program and before milk was pasteurized, 20 to 30 percent of tuberculosis cases in humans came either from contact with cattle or from drinking infected milk. We've almost eradicated that threat here, but bovine TB is still a public health issue in other countries."

A Timely Test

The invention comes at a time when livestock owners in Michigan and Texas are contemplating the effects of bovine TB on business.

"When a farmer or a rancher discovers TB in his herd, animal movement stops," Palmer says. "Other states are not going to allow those infected cattle in. It also affects animal trade internationally."

He notes that infected herds face destruction or quarantine for an extended and costly period that is followed by retesting. Waters says the outbreak has cost Michigan more than $50 million in increased testing and lost trade.

Palmer says the disease can spread from mammal to mammal through contact with saliva, nasal excretions, urine, and feces. "In the case of cattle, it occurs when deer enter the areas where cattle are raised and fed," he says.

Waters says the new assay, which was tested mainly on white-tailed deer, will be applied mostly to captive wildlife and livestock. "The method will not be used for testing of wild deer," he says. "It will help with monitoring animals that are moved—particularly across borders—to make sure the disease doesn't go undetected."

The invention may prove useful on species usually found in the wild but kept captive and transported for reasons related to food, hunting, and research. It may also help zoos, where, Palmer says, "tuberculosis is a bigger problem than you might think. That is especially true with animals coming from countries where TB is endemic. This test can be run on samples from animals before they are brought into the country or shared with other zoos."

The test should be a decisive weapon in the fight against a disease once thought defeated that has instead shown alarming persistence.—By **Luis Pons,** ARS.

This research is part of Animal Health, an ARS National Program (#103) described on the World Wide Web at http://www.nps.ars.usda.gov.

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